

Capital Costs for Water Reclamation Facilities

Capital costs for water reclamation facilities varies widely dependent upon factors including the Class of reclaimed water achieved, the facility size, whether this is a new facility or upgrade to an existing facility, the type of distribution system, and the end uses. Most of the reclaimed water facilities proposed in the state of Washington have been Class A facilities with a design capacity of 1.0 MGD or less.

Table 1 presents total capital cost information for the four Class A reclaimed water demonstration projects in Washington State. Three of the projects, Ephrata, Yelm and Sequim are close to 1.0 MGD design capacity. The average cost of these three projects is approximately \$7,900,000. The Royal City project, 0.25 MGD design capacity, provides a rough estimate for costs for smaller facilities at approximately \$3.5 million.

Table 1 – Washington Demonstration Projects Capital Facilities Costs: 1996 Dollars

Ephrata	1.12 MGD	\$6,843,000	Includes infiltration basins and uses at plant
Yelm	1.0 MGD	\$8,177,741	Includes distribution system and wetland park
Sequim	0.67 MGD	Facility upgrade: \$5,300,000 Total project cost: \$8,700,000	The additional \$3.4 million for upland distribution and use
Royal City	0.25 MGD	\$3,661,668	Includes infiltration basins and uses at plant

Wastewater Reclamation and Reuse, Asano, 1998, provides an estimate of the capital costs of reclaimed water for a larger number of projects in California. Table 2 provides a summary of this information. Most of the projects in the state of Washington are Class A reclaimed water and are less than 1.0 MGD. The average capital cost for a 1.0 MGD, Class A facility is \$7,362,500 which is in line with the costs of the demonstration projects shown in Table 1. Costs to produce Class B, C, or D reclaimed water would be closer to costs for secondary treatment facilities, approximately \$6.1 million for a 1.0 MGD facility.

Table 2 – Total Estimated Capital Construction Costs for Reclamation Treatment Facilities

	1.0 MGD	5.0 MGD	10.0 MGD
Primary Treatment	\$2,950,000	\$5,300,000	\$7,550,000
Secondary	6,100,000	14,400,000	24,900,000
	6,500,000	15,200,000	26,100,000
	5,700,000	13,200,000	24,950,000
Average	\$6,100,000	\$14,133,333	\$25,316,667
Class A Reclaimed	8,400,000	18,400,000	35,300,000
	6,900,000	15,700,000	30,000,000
	7,050,000	16,650,000	30,900,000
	7,100,000	18,100,000	34,500,000
Average	\$7,362,500	\$17,212,500	\$32,675,000

Sometimes a completely new facility does not need to be built. The secondary effluent can be further treated to produce Class A reclaimed water. Table 3 presents information on the incremental costs to add Class A reclaimed water capability to the effluent of an existing secondary wastewater treatment plant. For a 1.0 MGD facility, costs average between \$1.5 and \$2.5 million. This is between 21% and 36% of the total facility cost.

Table 3 - Estimated Incremental Capital Costs Associated with WWTP Upgrades from Secondary to Class A – Add Coagulation and Filtration, More Disinfection (Asano 98) 1996 Dollars

Class A Reclaimed	1.0 MGD	5.0 MGD	10.0 MGD
Conventional	\$2,650,000	\$5,050,000	\$9,550,000
Direct Filtration	1,450,000	2,950,000	5,450,000
In-line Filtration	1,550,000	3,650,000	6,100,000

Distribution costs also vary widely depending upon the size and extent of a distribution system, soil conditions, the type of materials that must be used, and whether or not the lines must be retrofitted in urban areas or are a part of new construction. Table 4 presents rough estimates of distribution costs from Asano's book averaged over a number of projects. Costs of retrofitting distribution lines are roughly twice the costs of new construction.

Table 4 - Distribution costs – Asano 98:

New systems (master planned communities)	\$175/acre-foot	\$2.49 per ccf
Retrofits (urban areas)	\$350/acre-foot	\$4.98 per ccf

The 2000 Report of the Reclaimed Water Task Force, convened by the King County Department of Natural Resources, contained detailed analysis of several reclaimed water proposals. According to that analysis," the cost per hundred cubic foot (ccf) of reclaimed water varies between \$4.01 and \$10.33. As a means of comparison, potable water rates charged to large irrigation users by utilities in the general project areas ranges from \$2.04 and \$4.28/ccf.

The 2001 report from the Central Puget Sound Water Supplier's Forum similarly concluded that "For reclaimed water to be used on a large scale ... it must be made available throughout the region at a price that appeals to potential users". Their analysis found that unit costs for reclaimed water projects ranged from \$11,000 to over \$13 million per mgd (million gallons per day) or \$0.02 to \$68.84 per ccf. Unit costs for traditional potable water supply options ranged from \$225,000 to \$1.5 million per mgd (\$0.12 to \$3.07 ccf).

The high and low projects analyzed may however represent statistical outliers. Taking out the high and low projects, the cost of other analyzed projects ranged from \$100,000 to \$924,000 per mgd (\$0.50 to \$4.20 per ccf). Review of the background information associated with the projects analyzed found that lower cost options tended to require very limited distribution facilities and produced calls C or D reclaimed water. Furthermore, the one very high cost option was to serve the Crystal Mountain Ski Resort. Though not described in detail, the costs of this project are likely driven up by the location of the project.

Asano, Takashi, Ph.D., P.E., editor Wastewater Reclamation and Reuse, Water Quality Mangement Library – Volume 10, Technomics Publishing Company, 1998.